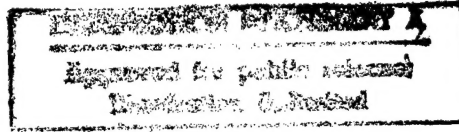


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JPRS 80949

1 June 1982



# China Report

SCIENCE AND TECHNOLOGY

No. 163

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FOREIGN BROADCAST INFORMATION SERVICE

1 June 1982

# CHINA REPORT

## SCIENCE AND TECHNOLOGY

No. 163

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## APPLIED SCIENCES

### REQUIREMENTS REVIEW, PROGRAM DEVELOPMENT IN AEROSPACE MEDICINE

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 4, Apr 82, pp 33-35

[Article by Chen Zurong [7115 4371 2837] ]  
Zhang Lifan [1728 4539 5672] ]

[Excerpts] Aerospace medicine is special branch of medical science which is devoted to the study of various medical problems encountered in aeronautical or space missions. Since the beginning of this century, the increasing demands of aerospace activities have motivated the evolution of aerospace medicine into an independent branch of science. Its main objectives are: to ensure the safety, well being, and comfort of flight personnel and passengers; to improve the work efficiency of flight crews to ensure the completion of aeronautical activities and space missions; and to participate directly in the development of aerospace technology.

#### The Status of Aerospace Medicine in China

Before the liberation there was essentially no progress in the field of aerospace medicine in China. The only activity was the establishment in 1932 of a training school for Air force military physicians. By 1948 the school graduated a little over 100 medical doctors. During the 32 years under the new Chinese government, specialized research and educational organizations, bed-side medical units, and an aerospace medical team have been established. A significant number of military doctors and aerospace doctors have been successfully trained. Chinese scholars in the field of aerospace medicine have definite contributions on basic theoretical research, in the development of protective and rescue equipment, in the promotion of flight hygiene, and in the improvement of physical conditions of flight personnel. More importantly, a foundation has been established by this initial effort for future development in this field. However, one must recognize the fact that aerospace medicine in China is still considerably behind world standards; in most aspects it cannot meet the needs of China's developing aerospace activities. Therefore, we should review our practical requirements and initiate a carefully planned systematic development program in order to accelerate the modernization of aerospace medicine in this country.

## APPLIED SCIENCES

### URANIUM LASER ANALYZER

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 6, 1981, p 13 (brief)

[Article by Bian Yousheng [0593 2589 3932]: "A Uranium Laser Analyzer Passes Evaluation"]

[Text] A meeting organized jointly by the Fifth Bureau of the Second Ministry of Machine Building and the Hangzhou City Electronic Instruments Bureau to evaluate the "JU-1 model" uranium laser analyzer was held in Hangzhou from August 10 to August 14. Fifty-five delegates from 34 units including the nation's geological departments, environmental protection departments, health departments and higher educational institutions conscientiously tested and examined the performance and technical specifications of the instrument, and they held demonstrations to analyze actual samples at the meeting. The delegates to the meeting carried out full discussion and unanimously agreed that the "JU-1 model" uranium laser analyzer developed by the Third Institute of the Second Ministry of Machine Building met the designed requirements in sensitivity (detection of uranium can reach 0.05 PPb), stability, and precision of measurement, and it has reached the level of similar foreign products. It has provided an effective analytical tool for the measurement of trace amounts of uranium in atomic research and development, geology, health and environmental protection and monitoring, and it has filled a gap in our nation. The meeting suggested that the Hangzhou Optical Electronic Instruments Plant organize trial production in large quantity to satisfy domestic needs.

9296

CSO: 5000/4022

APPLIED SCIENCES

CHINA'S BIOLOGICAL, METEOROLOGICAL ROCKETS

Beijing HANGTIAN [SPACEFLIGHT] No 2, 1982, inside front cover

[Photographs and Captions]

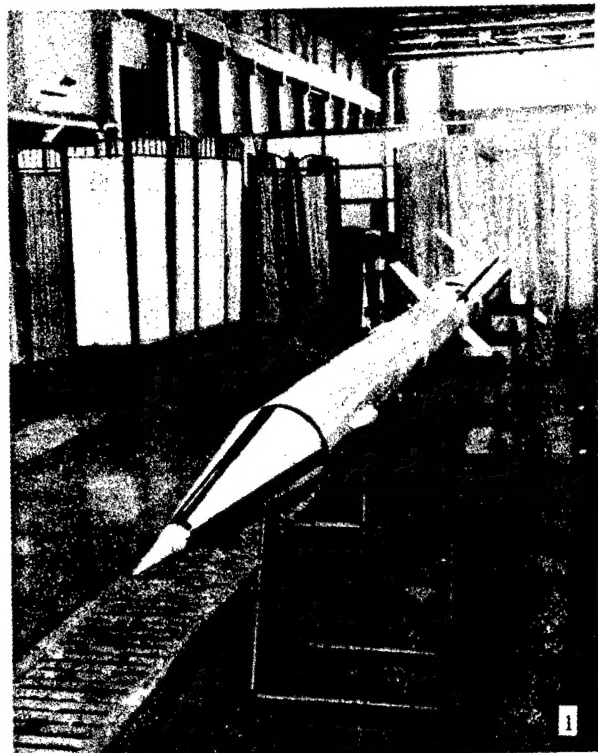


Fig. 1. Meteorological Rocket



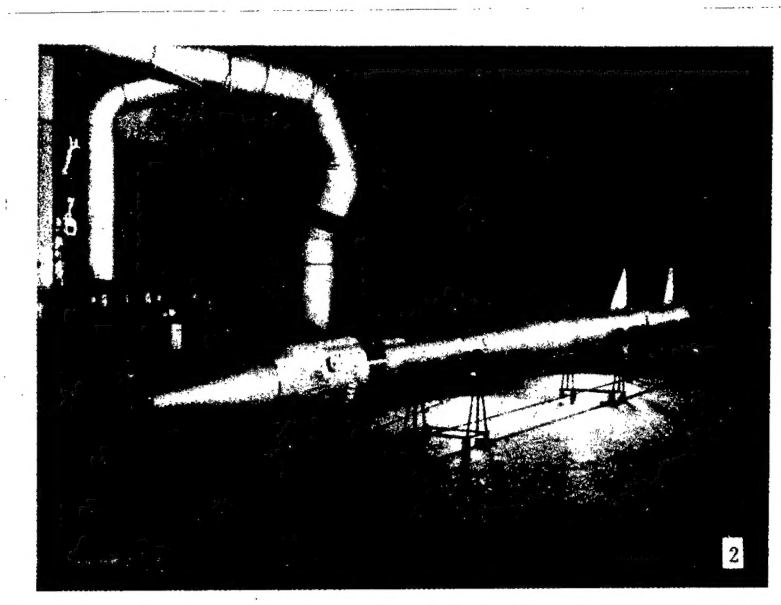


Fig. 2. Biological Experimentation Rocket

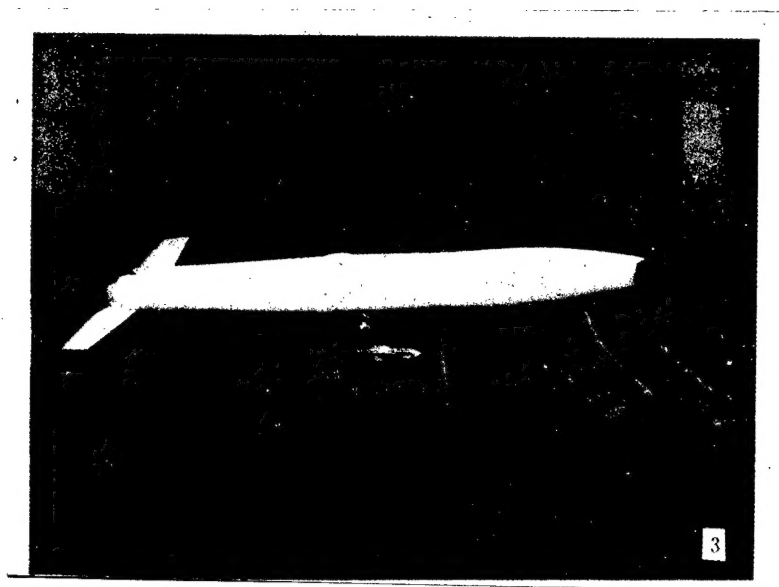


Fig. 3. Meteorological Rocket

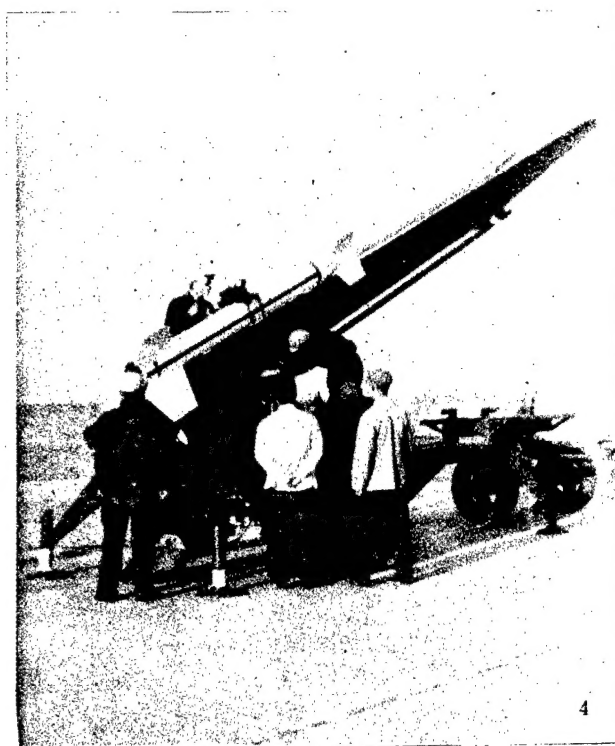


Fig. 4. Meteorological Rocket Being Prepared for Launching

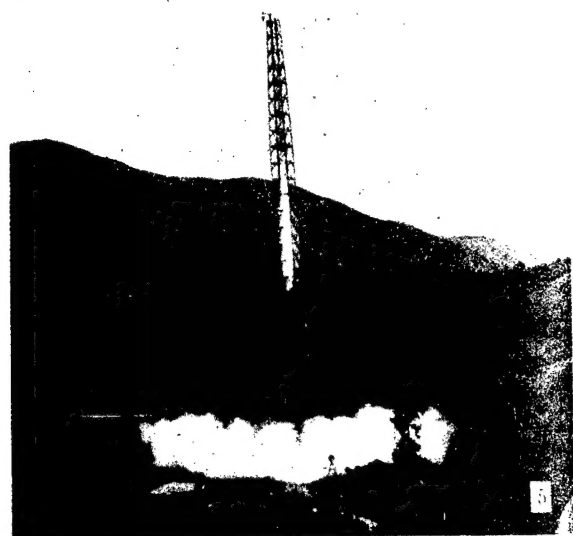


Fig. 5. Atmospheric Probe Rocket

## APPLIED SCIENCES

### CHINESE EVALUATE SA 365N DAUPHIN 2 HELICOPTER

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 4, Apr 82 pp 5-7

[Article by staff reporters of 'INTERNATIONAL AVIATION']

[Text] On 6 February 1982, the sky was clear, but the air around the capital's airport was filled with early spring chill. Rows of passenger cars carrying over a thousand spectators from all over the country were heading toward one of the flight test fields in the airport. They all came here to witness the first exhibition flight of the first SA 365N Dauphin 2 helicopter (No 6013) produced in this country.

At 9:30 sharp, accompanied by the roaring sound of the engine, a white and blue Dauphin 6013 was lifted from the ground. At a height of approximately 5 m, the helicopter made a sharp 90° turn to the right and began to climb upward with great speed. In a short while, it began demonstrating a number of maneuvers: diving and dashing at the review stand; climbing vertically and then hovering at an altitude of 400 to 500 m; making a 90° right turn followed by a left turn, and suddenly "dropping" straight down; then gradually climbing backward again as the spectators applaud with admiration. During the 15-minute performance, over 20 maneuvers were executed one after another; they fully demonstrated the superior mobility of the Dauphin helicopter.

As soon as the flight exhibit ended, the spectators rushed toward the helicopter to congratulate the Chinese and French pilots who took part in this exhibit. We took this opportunity to arrange an interview with the planning director of the Technology Advancement Department of the Chinese Aeronautical Technology Import-Export Company (CATC), asking him about the joint Sino-French effort in producing the Dauphin helicopter. We also located the chief engineer of the Harbin Airplane Factory to ask him about the main features of the Dauphin 2 helicopter. Finally, we interviewed the co-pilot of this demonstration flight, and talked about his experience in operating the Dauphin. The contents of these interviews are summarized below.

#### Sino-French Joint Venture

The SA 365N Dauphin 2 helicopter is a medium-size general purpose helicopter developed by the French Aerospatiale Company. It was evolved from the 365C model and was issued a French Aviation Certificate in 1981. It is a technologically advanced product of the late 1970's. Recently, China adopted the French manufacturing techniques and began production of the helicopter as well as the engine. Prior to reaching a decision to select this model, the CATC

had made a detailed analysis and comparison of the more advanced helicopters from various countries and had visited many companies abroad.

In July 1980, the CATC signed a technology transfer contract with the French Aerospatiale Company, which was later approved by both governments in October of that year. The contents of the contract were as follows: 1) France will transfer the complete set of technical procedures for manufacturing the helicopter and the engine to China; 2) France will initially deliver two completed helicopters to China; subsequently, it will deliver certain parts to be assembled in China; in time China will manufacture all the parts and assemble the entire helicopter. The Dauphin 6013 which took part in the demonstration was the first of the two helicopters which were flight-tested and certified in France and delivered to China on 29 January of this year. The contract also stipulated that as compensation China will return a certain quantity of manufactured helicopter parts to France. With this type of joint venture agreement not only can we learn the most advanced helicopter technologies and acquire the products with minimum time delay, but also save considerable foreign exchange by not directly purchasing the product from abroad.

#### Main Features of the Helicopter

The SA 365N Dauphin 2 helicopter is considered a fairly advanced product among helicopters of a similar class. It is light-weight, and has high speed capability; its moving parts are reliable and have relatively long design lives; it is also easy to maintain and operate. Its design was based on the following guidelines: large passenger cabin easy entrance and exit; high cruising speed and large effective payload; long range with good economy; high degree of maneuverability and mobility; long operating life between repairs and ease of maintenance. In the development and production of this helicopter, many advanced technologies were incorporated. The main features of this helicopter include the following.

**Composite Material Rotor:** The rotor consists of 4 blades made of fiberglass and graphite. The rotor type is OA2 212-207; it has a twist of  $10^\circ$ , a blade-tip sweep of  $45^\circ$ ; its turning efficiency is 0.75, and its nominal speed is 348 rpm. This type of composite material is strong and easy to machine; it was used on another helicopter Gazelle made by the French Aerospatiale Company. It has been reported that during an accident where two helicopters collided, the rotary blades of the Gazelle chopped the other helicopter into two halves; the body of the Gazelle was destroyed, but the rotary blades were essentially undamaged. Furthermore, metallic blades have poor corrosion resistance; they must be constantly inspected using microscopes to search for corrosion spots caused by sea water or chemical gas; if not discovered in time the corrosion spots may develop into cracks and cause the blades to fracture. Blades made of composite materials do not have this problem, which is a desirable property when operating over ocean surfaces.

The leading edge of each blade is covered with a stainless steel belt for protection against damage by debris. The four blades can also be folded backward to save parking space. The time required to fold the blades is approximately 10 minutes; for subsequent operation the blades can be directly unfolded without further adjustment. If one of the four blades is damaged, each can be replaced individually; the replacement blade can also be used without adjustment.

**Star-shaped Flexible Blade Housing:** This is one of the new composite material blade housings developed by France in the late 1970's. It has a star-shaped plate structure made of fiberglass and epoxide material. The plate arms have high damping rigidity and flexibility required for swinging motion; they also have visco-elastic damping devices.

The main advantages of this type of blade housing are that it does not require lubrication or maintenance, and it is highly reliable. For example, if a metallic blade housing develops a crack, it is likely to be destroyed under the action of centrifugal forces, and break into pieces. The composite material blade housing, on the other hand, will automatically stop operation under these conditions; furthermore, the cracked component will change color, making it easy to identify and replace. The composite material blade housing also has a simple structure, with only 64 parts, which is  $\frac{4}{5}$  less than the metallic blade housing of the Alouette; its weight is only 57 kg, which is 55 percent that of the Alouette. The Dauphin helicopter suffers little vibration during flight; this is partly due to the vibration-suppressing counterbalance weight in the rotary blade, and partly due to the special design of the blade housing. The reduced vibration level results in extending the useful life of each component of the helicopter, and the airborne instruments and equipment.

**Culverted Tail Rotor and Nonsymmetrical Vertical Tail:** The tail rotor is located within the vertical tail. It has 13 rotor blades; its diameter is 0.9 m, and its speed is 4,700 rpm. The life span of the tail rotor blades is essentially infinite, and there is no lubricated axle. This type of tail rotor is safer than the conventional type in that it will injure ground personnel, and the pilot need not worry about it hitting objects on the ground or tree tops when operating at low altitudes.

The vertical tail of the Dauphin has a relatively large area and uses a nonsymmetrical wing design, so that it can produce a certain amount of counter-torque. Even when the tail rotor fails, this design will enable the helicopter to return to the airport at cruising speed, and perform a glide landing at a speed of 75 km/hr. This countertorque also allows the helicopter to cruise at high speed with almost no power loss due to the tail rotor. Therefore, the fuel consumption of the Dauphin is less than helicopters with conventional tail rotors, and its range is correspondingly increased.

**Propulsion System:** This helicopter has two Arriel 1C turboengines developed by the Turbomeca Company during the 1970's. The peak power of each engine is 710 hp; the power to weight ratio can be as high as 6, and the fuel consumption is only 250 g/hp-hr. The engines are equipped with an automatic power equalizing device, so that when one of the engines fails, the other will automatically increase its power to an emergency level. Therefore, the Dauphin helicopter can perform a type-A take-off under full load conditions; conventional helicopters under similar conditions must reduce payload (passengers or fuel) to meet aviation regulations. The single-engine climb rate can be as high as 1.7 m/sec. In addition, the engine also has a fast-response advancing device connected to the blade pitch, which allows the power to increase from minimum to maximum in only 2 seconds.

The engine structure is of a molded design, which only has 5 unit components. To disassemble the engine into individual units only takes 8 minutes; to

assemble the engine requires 24 minutes. When the engine is malfunctioning, it is only necessary to replace the unit which is defective.

**Composite Material Body Structure:** The body structure contains 59 percent composite material, 28 percent aluminum-Nomex sandwich structure, and 13 percent conventional riveted aluminum structure. This type of structure not only results in a reduction in weight, but also in the manufacturing cost and aerodynamic drag. As a result of a series of weight reduction measures, the maximum ratio of take-off weight to empty weight can reach 1.95. Therefore, even though the exterior of this helicopter does not differ a great deal from that of other light-weight helicopters such as Alouette 3 or the Bell-212, its cabin capacity (5 m<sup>3</sup> plus luggage compartment) is larger, and its load capacity is comparable to that of the U.S. S-76.

**Safety Features:** The Dauphin helicopter has redundant hydraulic, fuel supply, and electric systems, some of which even have three-unit redundancy. The dimensions of all mechanical components have relatively large tolerances so that in case of a failure in the lubrication system, the helicopter can continue to fly for 30 minutes, during which time the pilot can call for help or attempt an emergency landing. Other emergency measures include an emergency fuel dumping system which can release all the fuel in a few seconds, and emergency pontoons in case of forced landing over the ocean. The emergency pontoons are normally stored inside the body so it does not affect the flight speed; if the helicopter is forced to land over the ocean, the pontoons are automatically inflated within a few seconds (see title figure); at the same time two life rafts each having a 10-person capacity automatically slide down from top of the cabin and after inflation stand ready at two sides of the helicopter. The fuel tank and the tail section of the helicopter are both sealed structures with good buoyancy characteristics. On conventional helicopters, the rotor cannot be started in a high wind exceeding 75 km/hr; otherwise the helicopter may topple over. The Dauphin 2 on the other hand is equipped with star-shaped blade housing and stopping blocks on the blades, so that it can be started safely even in a strong wind with 100 km/hr wind velocity. Therefore, the Dauphin 2 can operate in a strong wind with intensity 7 over the ocean.

**Maintainability:** The Dauphin 2 helicopter generally requires a minor repair every 300 hours and a major repair every 2,400 hours; the maintenance time for each flight hour is 0.47 hours, whereas some helicopters require as many as 11 hours. The procedures for disassembling and assembling mechanical parts are quite simple. By using the special tools in the luggage compartment and a small crane, a technician and the pilot can remove the four blades in 10 minutes (8 minutes for installation), disassemble the blade housing and the main speed-reduction unit in 1 hour 50 minutes (1 hour 13 minutes for installation), and remove the engine in 1 hour 30 minutes (1 hour for installation). The helicopter also has good accessibility. In addition to the two doors to the cockpit, there are four doors to the passenger cabin. On each side of the helicopter is a retractable stepping board; there is also a door to the luggage compartment. The main speed-reduction unit has many inspection windows through which the operating conditions can be monitored. The units which require frequent maintenance all have hinged covers; the entire nose section is also a hinged cover which in its open position will clearly reveal all the circuitry of the onboard equipment and instruments for easy maintenance (see back cover). Therefore, since the delivery of the SA 365N last year and its

predecessor SA 365C in 1978, there have never been any accidents during operation.

### Performance and Applications

The helicopter's main performance parameters are listed as follows:

maximum gross weight	3,850 kg
effective payload	1,810 kg
maximum external load	1,700 kg
maximum continuous power	594x2 hp
maximum speed	306 km/hr
cruising speed	260 km/hr
maximum range	882 km
maximum climb rate	7.7 m/sec
dynamic ceiling	4,000 m
hover ceiling	2,350 m (with ground effect) 1,200 m (without ground effect)
fuel consumption per km	1.06 kg

Compared with other helicopters of its class, the outstanding features of the Dauphin 2 are: larger payload, longer range, higher speed, and better economy. For example, the maximum range of the Bell-212 is 47 percent less, that of the Bell-412 is 28 percent less; the fuel consumption of the Bell helicopter is 1.5 kg/km whereas that of the Dauphin 2 is only 1.07 kg/km. Therefore, the higher initial cost of the Dauphin 2 is more than compensated by its long-term economy and its reliability. However, it must be pointed out that the SA365N helicopters currently being produced in France do not all meet the performance specifications stated in the Sino-French contract. The French Aerospatiale Company is currently taking measures to correct this situation.

The Dauphin 2 has many applications. There are about 50 selected services suggested by the French Aerospatiale Company. The basic model can be easily modified to perform special missions such as off-shore petroleum operations, transportation of personnel, off-shore support activities, rescue operations, elevated construction work, installation of high-voltage lines, aerial photography, geological exploration, oceanic patrol, and forest fire prevention. The U.S. Coast Guard recently ordered 90 Dauphin 2's for its short-range retrieval operations; Canada and Saudi Arabia also purchased the Dauphin 2 for their petroleum exploration activities. The French Aerospatiale Company has also developed military versions of the helicopter such as the SA 365F Dauphin 2.

### Operating Characteristics

The co-pilot who participated in this flight demonstration, Comrade Ye Guanwei [5509 6034 4850], had spent more than 3 months in France for flight training. Except for a few very special subjects, he had mastered most of the training courses. He considered the Dauphin 2 an outstanding helicopter: light-weight, good aerodynamic design, retractable landing gears, and high speed—during a dive the maximum speed can reach 324 km/hr, which is quite unusual for helicopters of this class. Furthermore, the maximum range can reach 350 km; but if the fuel tanks are loaded to full capacity, then only 6 passengers can be accommodated (normal capacity 10-14 passengers). Comrade

Ye Guanwei was most impressed by the maneuverability of the helicopter. Compared with other helicopters he had flown, he considered the control system of the Dauphin 2 to be more complicated, but once familiar with the system, it becomes very easy to maneuver the helicopter. During this flight demonstration, the high degree of mobility allowed a number of difficult maneuvers to be executed with little control. However, high mobility implies poor stability; thus when the helicopter encounters a disturbance such as a wind gust, it tends to sway more than others. Comrade Ye did not notice any difference in the control characteristics between a culverted tail rotor and conventional tail rotors, but the improved safety of the culverted tail rotor gives the pilot psychological peace of mind.

3012

CSO: 4008/158



AUTHOR: ZHOU Xiwen [0719 6932 2429]

ORG: None

TITLE: "Analysis of Regulation Performance of a Variable Thrust Rocket Engine Control System"

SOURCE: Beijing YUHAN XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS]  
in Chinese No 1, 31 Jan 82 pp 18-29

ABSTRACT: This paper introduces mainly a control circuit of variable pulse bandwidth to control 2 high performance electromagnetic valves. Through the variation of fluid flow volume, they change the pressure of hydraulic chamber of the injector to cause the needle valve of the injector to move up and down to vary the circulating area of the injector so as to control the variation of flow of the propellant to realize variable thrust. The control system is composed mainly of the control circuit, the electromagnetic valve, and a thrust chamber having a variable area injector. Based upon the constituent parts and the actual operation process of this rocket engine, mathematical models of the various links are established, using the transfer function method to analyze the dynamic and static properties of the rocket engine control system. Major factors influencing its dynamic properties and static errors are explained. Diagrams are included to depict the operation principle and the structure of the various components.

This paper was received for publication on 21 Nov 80.

AUTHOR: FAN Jianfeng [5400 0494 1496]

ORG: None

TITLE: "Selection of Launch Time for Near-Earth Spacecraft With Mission of Visible Photograph"

SOURCE: Beijing YUHAN XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS]  
in Chinese No 1, 31 Jan 82 pp 98-103

ABSTRACT: Using the equatorial coordinate systems to compute an arc of the earth capable of being photographed under visible light, the paper proceeds to obtain  $\Omega_0$ , the initial time of a given visible arc of the earth before determining the local time of every point on that arc. The relationship between the time the satellite enters the orbit and  $\Omega_0$  is explained. In this manner, the paper establishes a set of formulas for selecting the launch time of a satellite to provide it a maximum photographic latitude or the best possible visible light to photograph a given area of the earth's surface.

This paper was received for publication on 17 Dec 79.

6248

CSO: 4009/303

AUTHOR: XIANG Dingpu [0686 7844 3877]

ORG: Research Institute of Geology, Gansu Provincial Bureau of Geology

TITLE: "Volcanic Rocks and Volcanism of the Qilian Mountains of China"

SOURCE: Lanzhou IANZHOU DAXUE XUEBAO [JOURNAL OF IANZHOU UNIVERSITY] in Chinese  
No 1, 28 Mar 82 pp 91-105

ABSTRACT: The structural units of Qilian Mountains may be divided from the north to the south into the following: (1) A geosynclinal fold on the margin of Hexi Corridor; (2) A eugeosynclinal fold belt with ophiolites; (3) A central uplifted belt; (4) A taphrogeosynclinal fold with ophiolites; (5) A miogeosynclinal fold. Five ancient ophiolite suits ( $Z_c-Z_j, \epsilon_{2,0_1,0_2,0_3}$ ) may be recognized. The Middle-Late Cambrian suit is observed only in the 4th unit of Lajishan and not to the south of it. The volcanic activities of Qilian Mountains are mainly central eruptions and a few crack eruptions. All volcanic rocks may be classified into the following: (1) The spilite-keratophyre series, such as the basic to acid volcanic rocks of the north; (2) The trachyte-feldspatite series, distributed only in the north, being rich in potassium; (3) The dacite-basaltic series, including Precambrian volcanic rocks of Lajishan and further south. This paper is mainly a summation of survey reports of Gansu, Qinghai, etc. and other related data of scientific research. Some maps and tables are included to help the narration.  
This paper was received for publication on 8 Nov 80.

AUTHOR: LI Yulong [2621 3768 7893]  
ZHANG Weixin [1728 4850 0207]  
XU Shuying [1776 0647 7751]

ORG: LI of Lanzhou Research Institute of Seismology Chinese Academy of Sciences;  
ZHANG, XU of Department of Geology and Geography, Lanzhou University

TITLE: "Basic Neotectonic Characteristics of the Four Provinces of Shaanxi, Gansu, Ningxia, and Qinghai"

SOURCE: Lanzhou IANZHOU DAXUE XUEBAO [JOURNAL OF IANZHOU UNIVERSITY] in Chinese  
No 1, 28 Mar 82 pp 106-119

ABSTRACT: The 4 provinces of Shaanxi, Gansu, Ningxia, and Qinghai cover an area of 1.6 million  $\text{km}^2$ , amounting to 1/6 of the territory of China. In this region, the 3 geotectonic zones of China: the Xizang fault block, the Xiyu [Xinjiang and parts of Central Asia] fault block, and the China proper fault block merge while the southern tectonic belt pierces through the middle to cause the geotectonic conditions to be extremely complex. Compared with other regions of China, the neotectonic movement here shares certain similarities, yet it is also obviously different. It contains 35 major active fracture zones, 3 graded plains, and more than 60 tectonic basins of various sizes. These units and their deformed shapes are described. There is also a table comparing the scale and speed of uplift of 18 mountain regions since the end of the Pliocene Epoch. This paper is largely an analysis of field observation data of many years, carried out by the authors and other colleagues.  
This paper was received for publication on 6 Jan 81.

## Machine-Building

AUTHOR: ZHANG Bin [1728 2430]

ORG: None

TITLE: "Contactless Silicon-controlled Sequential Control Device Successfully Made"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 2, 1982 inside front cover

ABSTRACT: With the cooperation of Liuzhou Municipal Rectifier Plant, the Guangxi Research Institute of Machine Industry has successfully made silicon-controlled sequential control devices in 3 types and 6 specifications. The prototypes have been used on the automated production line of rotary zinc plating in the Liuzhou Municipal 434 Plant, the automated dam processing line of Nanning Municipal Meat Cooperative Plant, and the automated bearing inner ring machining of Nanning Municipal Bearing Plant. These production operations have proved that the devices meet design requirements. A certification meeting was organized in Nanning City on 10-13 Nov 81 by the Guangxi Zhuang Nationality Autonomous Region Science Committee and the Bureau of Machine Industry. All delegates to that meeting agreed that the devices have simple circuit designs, complete basic functions, and are of low cost. On such problems as the silicon-controlled stepper switch, separation of input signals, input logic computation, skip, delay, etc. the circuit design is rather unique. The switch signal allows direct input for various logic computations and has a relatively high direct output capability. The devices are not only inexpensive to make, they are also inexpensive to use, maintain, and service.

AUTHOR: None

ORG: The Secretariat, Society of Machine Industry Automation

TITLE: "Numeric Control Application Software Technology Exchange Meeting Held in Guangzhou"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 2, 1982 inside front cover

ABSTRACT: The Numeric Control Application Software Technology Exchange Meeting sponsored by the Chinese Mechanical Engineering Society and the Machine Industry Automation Society, was held on 9-14 Jan 82 in Guangzhou. Participants included 60 delegates representing 46 organizations of the country. During the meetings, 14 papers were read and the information of 10 others was discussed, including such subjects as magnetic disk graphic information transfer program, etc. Numeric control application softwares include numeric system control softwares, automatic programming system softwares, and user application softwares, etc. The research on numeric control machines began in China in 1958 but the study on numeric control automatic programming did not start until 1965 while it was not until 1976 before studies on numeric control softwares were launched. In China, very few persons are engaged in software research. The ratio between software and hardware researchers is 1 : 10 and in foreign countries it is generally 1.5 : 1. With poor research techniques and long project duration, software research teams are urgently in need of reinforcement. The delegates offered many suggestions.

AUTHOR: ZHAO Huating [6392 5478 1656]

ORG: Beijing Municipal Bureau of Machine Industry

TITLE: "A Discussion on Machine Industry Automation"

SOURCE: Beijing JIXIE GONGYE ZIDONGHUA [MACHINE-BUILDING INDUSTRY AUTOMATION] in Chinese No 2, 82 pp 39-40, 23

ABSTRACT: Economic development depends mainly on raising the productivity of labor while automation is mainly to guarantee the quality of products and to increase labor productivity at the same time. The goal of automation is; therefore, mainly to obtain the optimal economic effect. It is not simply to advance technology. The developmental trend of the machine industry indicates that the high tide of mass production is gone. The sort of products that have been produced the same old way for decades and decades are dying out daily. New products and new types emerge all the time and the machine industry must be able to turn around quickly, to produce many products, and to achieve high quality and high efficiency of medium and small batch production. Methods for reforming production and expanding productivity must be contained within the machine industry itself. The author seeks to explain in the paper that the development of capabilities of automated production of medium and small batch products is a necessity dictated by the force of time and circumstances and is not just a blind pursuit of progress. Many domestic and European events occurring in the machine industry are cited to demonstrate this viewpoint.

6168

CSO: 4009/306

AUTHOR: WANG Zlin [3769 2737 2651]

ORG: Hot Working Division

TITLE: "Broad Temperature Range Germanium Resistance Pyrometer Certification Conference Called in Wulumuqi City"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82  
p 18

ABSTRACT: The conference for the certification of the broad range germanium resistance pyrometer was called jointly by Xinjiang Weiwur Autonomous Region Bureau of Metrology and the Xinjiang Branch of Chinese Academy of Sciences. The instrument was designed and made by Xinjiang Research Institute of Physics Chinese Academy of Sciences. The China Academy of Metrology and the Xinjiang Research Institute of Physics proceeded with testing the instrument at 2-100 K standards. Before the conference got underway, the Low Temperature Office of the Chinese Academy of Metrology also called a meeting to test its low temperature standards. A total of 31 delegates representing 17 organizations attended the certification conference. All agreed that the short term repeat characteristic and the 2-month stability of the instrument are both 0.5 mk, which is the level of similar products of foreign countries. At present, Xinjiang Research Institute of Physics has the capability of producing it in small batches and is prepared to supply domestic needs for low temperature measurement.

AUTHOR: SU Hong [5685 9464]

ORG: Yunnan Provincial Research Institute of Metrological Testing

TITLE: "Successful Manufacture of Laser Fiber Gauge Measuring Instrument"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82  
p 22

ABSTRACT: Yunnan Provincial Research Institute of Metrological Testing has, most recently, succeeded in making the JXC-1 laser fiber gauge measuring instrument. It utilizes the light diffraction theory, with laser as the light source, to proceed with noncontacting measurement. A certification committee was organized by Yunnan Provincial Science Committee, special schools of higher education, scientific research organizations, and applications departments to carry out technical examination of that instrument. Its technical properties were found to be satisfactory, with the following specific data: (1) The range of measurement:  $0.03 \text{ mm} \leq d \leq 0.30 \text{ mm}$ ; (2) Precision of measurement: When  $d < 0.10 \text{ mm}$ , the maximum error does not exceed  $\pm 0.5 \mu\text{m}$ ; when  $d \geq 0.10 \text{ mm}$ , the relative error is not greater than 0.5 percent. The successful manufacture of that instrument provides the advanced means to measure small caliber metal filament, carbon filament, and chemical fiber in the precision requirements of national defense, scientific research, production, and foreign trade departments.

AUTHOR: LI Xin [2621 2946]

ORG: None

TITLE: "Certification Conference Approved the Laser Rockwell Hardness Reference and the Laser Surface Rockwell Hardness Reference"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82  
p 34

ABSTRACT: The Laser Rockwell Hardness Reference and the Laser Surface Rockwell Hardness Reference, which have been successfully made by the Chinese Academy of Metrological Sciences, the branch of that Academy, Shanghai University of Science and Technology, Wuzhong Material Test Machinery Plant, Shanghai Research Institute of Machine Manufacturing Industry, Shanghai Scientific and Optical Instrument Plant, Wuhan Material Protection Research Institute, Shanghai Diamond Tool Plant, underwent certification in Chengdu City. Delegates, representing 40 organizations, and 60+ related specialists participated in the certification conference. Following serious discussions and inspections, all agreed that the instruments are accurate, stable, and technically advanced. Their indices have reached the internationally advanced standard. The precision of the laser rockwell hardness reference is  $\pm 0.10\text{HR}$  and its long term stability is no less than  $0.15\text{HR}$ . The precision of the laser surface rockwell hardness reference is  $\pm 0.2\text{HR}$  and its long term stability is no less than  $0.3\text{HR}$ . They are approved as national base standards. Their participation in international comparison is suggested so that they may contribute to the unified measurement of Rockwell hardness, as the quality of these instrument warrants.

AUTHOR: LI Hui [2621 2585]

ORG: None

TITLE: "Three-phase Electric Energy Standard Verification Instrument Successfully Produced"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82  
p 49

ABSTRACT: The three-phase electric energy standard verification instrument made by Liaoning Provincial Research Institute of Metrological and Testing Technology, with the cooperation of the Liaoning Provincial Scientific Instrument Plant, Shanghai Electrical Meter Plant, and Yingkou Radio Plant No 6. Advanced digitized display is adopted and the measurement precision is  $5/10,000$ . This instrument not only fills a blank of China's electric energy measurement standard but also contributes to unifying measurement precision of electric energy toward developing energy conservation work.

AUTHOR: WANG Huaidao [3769 3037 6670]  
XU Pingniu [6079 1627 3662]

ORG: Both of Office of Heat, Zhengzhou Municipal Institute of Metrology

TITLE: "RZZ-1 Thermocouple Automatic Verifying Instrument"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 2, 18 Mar 82  
p inside back cover

ABSTRACT: At present, thermocouples are being checked manually with limited efficiency and precision. With the support of Zhengzhou Municipal Science Committee, the institute succeeded in making the RZZ-1. It has digital display, programmed control, and automatic print-out to realize automatic checking and automatic print-out of test results. The work efficiency is thus improved and the labor intensity is reduced. Furthermore, that instrument can also complete the automatic annealing and cleaning procedures of thermocouples of industrial use. In Jun 80, the instrument underwent certification and was approved. The major technical indices and the work theory of the instrument are introduced.

6168

CSO: 4009/298

## Metallurgy

AUTHOR: CAO Xueren [2580 1331 0088]  
FENG Yingjun [7458 2019 6874]

ORG: Both of the Baotou Research Institute of Metallurgy

TITLE: "Recent Picture and Outlook of the Use of Rare Earth Metals in Steelmaking in China"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 3, 1982

TEXT OF ENGLISH ABSTRACT: A general review of the use of rare earth metals (REM) in steelmaking in China for the past 20 years is presented.

Through a large amount of research and industrial trials, steels containing RE have been produced. Practice shows that REM additives improve transverse impact toughness and ductility of low carbon and low alloy steels, improve hot workability of high alloy steel and increase service life of resistance alloy wires, improve low temperature impact toughness and temper brittleness of structural alloy steels, prolonging fatigue life of steel products. REM also find application for improving as-cast structure and decreasing cracking tendency of steel castings and contincast slabs.

Earlier REM additives were simply thrown into furnaces or ladles, resulting in low REM recovery rate, ladle nozzle blocking during teeming, instability of steel properties and microdefects. The nature of nozzle blocking was studied and the measures

[Continuation of GANGTIE No 3, 1982]

for lightening or avoiding nozzle blocking were adopted. At present, methods of hanging REM rods in ingot molds and plunging the REM additives into ladles are in common use. The RE addition in the form of RE-oxide as the slag ingredient in the electroslog refining process has been proved successful and is now being used in production.

The mechanism of the effects of RE on steel properties is also described. To date, REM is chiefly added to control inclusion shape and to give a cleaning effect. The problem of the alloying effect of RE should not be overlooked, although solid solubility of RE in steel is very low. It might be thought that the segregation of RE at grain boundaries and the interreaction between RE and tramp elements or alloying elements in steel may give rise to certain effects to the properties of steel.

Finally, the outlook for the use of REM in the steel industry is also described.

9717

CSO: 4009/305



AUTHOR: LI Shimin [2621 0013 3046]

ORG: None

TITLE: "Condition of External Desulfurization of Panzhihua Steel Furnace"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 3, Mar 82 p 75

ABSTRACT: The molten vanadium, titanium, iron is a low silicon and high phosphorus, sulfur, iron mixture. At the same time, due to the fact that the sulfur content of the blast furnace raw material, pitch coke, increases year after year, the sulfur content of the pig iron also has the tendency of rising daily. The desulfurization burden for either blast furnace or converter is not economically or technically reasonable, however. Sometimes, it is even impossible. In 1980, the authors designed by themselves a set of blow desulfurization equipment which was installed for industrial experiment in 1981. With some continued improvements to the equipment, the blow system was made to operate normally and to produce a relatively satisfactory result. The desulfurization effects of 46 experiments are as follows: With 3-6, 6-7, and 8 kg/t of desulfurizing agent, the desulfurization rate is 50-74.3, 81-88.6, and 92.9 percent respectively. If ccc dry desulfurizing mixture is used, the desulfurization rate may always be above 80 percent. At present, a second round of experiments are being carried out to prepare the optimal formula for the desulfurizing agent, to appraise the economic benefits, and to provide design parameters for constructing large desulfurization stations at the steel mill.

AUTHOR: BAI Bingzhong [4101 0014 0022]

ORG: None

TITLE: "Experience Exchange Meeting on Dedusting and Environment Protection Techniques in Steel Industry"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 3, Mar 82 p 75

ABSTRACT: The Scientific and Technological Information Network of the Department of Steel Refining, Ministry of Metallurgy organized a dedusting and environmental protection technology in steel refining experience exchange meeting, which was held on 10-15 Dec 81 in Anshan. Participants included 74 delegates representing 55 production, scientific research, designing, and educational organizations. Discussions included some major aspects of converter smoke oxygen cap blowing purification and reclamation technique, wastewater and wastesludge treatment techniques, open-hearth furnace oxygen cap blowing electric dedusting technique, and their economic analyses. The delegates agreed that in China, the environmental protection technology in steel industry is a great deal behind the advanced level, but some obvious achievements have been made. These achievements and some proposals for possible immediate adoption, including noise control in steel refining shops, are briefly mentioned in the paper.

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CSO: 4009/305

Metallurgy

AUTHOR: ZHU Guang [4554 0342]

ORG: None

TITLE: "A Meeting to Certify Molybdenum Plate Used in Silicon-controlled Rectifiers and Electric Vacuums Held in Benxi"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 1, Mar 82 p 80

ABSTRACT: The project of studying and making the molybdenum plate to be used in silicon-controlled rectifiers and electric vacuums was jointly completed by the Zhongnan Institute of Mining and Metallurgy and the Benxi Municipal Colored Metal Company Tungsten and Molybdenum Products Plant. The meeting to appraise the product sponsored by the National Colored Metal Management Bureau was held in Benxi on 24-26 Nov 81. Representatives of the 2 producing organizations delivered separate reports to introduce the research and manufacturing process. In consideration of the problem of poor strength, serious problems of brittleness and layered separation, surface blemishes, etc. of the molybdenum plates made in China, the Ministry of Metallurgy directed the institute in 1979 to study the reasons for these shortcomings. Since then, 6 special reports on the project had been published. In Mar 81 the Ministry of Metallurgy signed a contract with the institute and the Benxi Colored Metal Company Tungsten and Molybdenum Product Plant to experiment with producing a molybdenum plate of better quality. The final product had been certified by Shanghai Rectifier Plant and Xian Rectifier Research Institute, etc. to be 90 percent useful in making silicon-controlled devices, compared with the 40-50 percent rate of the old plate. The new product is rated as 78.8 percent usable for making electric vacuums. All delegates to the meeting approved the certification of the product.

AUTHOR: LYU Haibo [0712 3189 3134]  
ZHAO Muyue [6392 1970 1971]

ORG: None

TITLE: "The 1981 Annual Meeting of the Powder Metallurgy Committee of Chinese Metal Society Held in Changsha"

SOURCE: Shangsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 1, Mar 82 p 80

ABSTRACT: The 1981 Annual Meeting was held in Changsha on 7-11 Dec 81. Participants included 115 delegates representing 91 government, research, and producing organizations. The opening speech was delivered by LIN Zhifang [2651 1807 5364] Deputy Chairman of Hunan Provincial Science Committee. Prof HUANG Peiyun [7806 1014 0061] reported the work of the P/M Committee in 1979-81 and introduced the condition of the Sino-American Conference of Metallurgy. Before the meeting began, 145 papers had been received and a volume of abstracts was compiled. In addition, 51 papers were selected for delivery during the meeting. The Scientific Activity Committee discussed the planned activities for 1982. Lectures on P/M sintering theory and on heat equivalent static pressure technology are to be scheduled in Beijing and Yinchuan respectively.

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CSO: 4009/304

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